

operators may try selectively **dropping** or **shedding loads**, purposefully disconnecting some customers to prevent equipment damage or widespread loss of load. Whether planned or unplanned, electrical outages can be inconvenient, costly and even dangerous to customers, especially in winter during a cold snap.

Consequently, BPA needs to improve its transmission system to ensure continued reliable electrical power for Puget Sound area customers and other regions.

S.1.2 BPA's Purposes

"Purposes" are goals to be achieved while meeting the need for the project. These objectives are used to evaluate alternatives proposed to meet the need. BPA will use the following purposes to choose among the alternatives:

- Facilitate the orderly planning of the region's power system [Northwest Power Act (16 USC section 839(3)(B))];
- Increase BPA system capacity to meet growing customer demand for electricity (Northwest Power Act 16 USC section 839(4) and 16 USC 839a(4)(A)(i));
- Maintain BPA transmission system reliability [Federal Columbia River Transmission Act (16 USC 838b(d); Northwest Power Act 16 USC section 839(2) and 16 USC 839a(4)(A)(i)];
- Maintain environmental quality [Northwest Power Act 16 USC 839(3)(C)];
- Minimize impacts to the human environment through site selection and transmission line design (National Environmental Policy Act 42 USC 4321 et seq., and Endangered Species Act 16 USC 1531 et seq.)
- Minimize costs to BPA's ratepayers [Northwest Power Act 16 USC 839(2) and 16 USC 839a(4)(A)(ii)] while meeting BPA's long-term transmission system objectives for the area.

S.2 Alternatives

BPA conducts region-wide transmission planning studies annually. Looking several years into the future to ensure reliable electric service, the studies use a computer model called a "power flow" to represent the system as it is expected to operate. The studies indicate a new transmission line is needed by winter 2002-03 to reliably serve potential peak load in the Puget Sound area during an "extreme" cold weather event and by winter 2005-06 to serve even "normal" peak winter load.

Based on this information, an energization date of fall 2002 for a new line was proposed.

BPA described and analyzed transmission route alternatives in a draft environmental impact statement (DEIS) released in June 2001. The DEIS identified a preferred alternative that would parallel an existing BPA transmission line through the Cedar River Municipal Watershed (CRW). BPA received over 700 comments from landowners, agencies, tribes and special interest groups on the DEIS. Many of the comments suggested BPA re-evaluate the range of alternatives considered and prepare a supplemental draft environmental impact statement.

After reviewing the comments and refining the cost estimates associated with BPA's preferred alternative, BPA decided to prepare this SDEIS to re-evaluate alternatives not analyzed in detail in the DEIS. The added transmission alternatives, all located outside of the CRW, were initially considered but dropped from detailed analysis. They are identified as Alternatives A, B, C, and D (see Map 1). Alternatives A and C are located to the south and west of the Cedar River Watershed. Alternatives B and D cross the Mt. Baker-Snoqualmie and Okanogan-Wenatchee National Forests. Under all transmission alternatives, Echo Lake Substation would be expanded about three acres to the east and new equipment to accommodate the new line would be installed.

BPA is also considering a Non-Transmission Alternative and the No Action Alternative.

➤ For Your Information

A **single-circuit** line has one electrical circuit per structure.

Tap - Point at which a transmission line is connected to a substation or other electrical device to provide service to a local load.

S.2.1 Proposed Action

BPA proposes to build a **single-circuit** 500-kV transmission line from a **tap** point on an existing 500-kV line near Kangley, Washington, to its Echo Lake Substation near North Bend, Washington. The proposed route for this line, also called Alternative 1, is nine miles long (see Map 2). Five miles of the proposed route would go through the Cedar River Municipal Watershed. In addition, Echo Lake Substation would be expanded about three acres to the east and new equipment would be installed there to accommodate the new line.

This alternative was proposed because it would be located immediately parallel to an existing 500-kV transmission line. Locating a new line next to an existing one minimizes right-of-way (**ROW**) clearing needed for the new line and reduces construction of additional access roads (only 2.9 miles of new access roads needed). About 0.6 miles of access road would be removed from service. However, the Proposed Action would displace two residences and a barn near Kangley, and impact a proposed subdivision.

The estimated construction cost for the transmission line is \$23.5 million, plus the estimated \$6.5 million for expanding the

➤ For Your Information

Mitigation — Steps taken to lessen the effects predicted for a resource. They may include reducing the impact, avoiding it completely, or compensating for the impact. Some mitigation, such as adjusting the location of a tower to avoid a special resource, is taken during the design and location process. Other mitigation, such as reseeding access roads to desirable grasses and avoiding weed proliferation, is taken after construction.

substation. The additional cost of **mitigation** measures would increase the Proposed Action's overall cost by about \$5 million, for a total project cost of \$35 million. The following mitigation measures are proposed:

- use of special design elements such as micropile footings;
- erection of towers in the Cedar River Municipal Watershed using a helicopter;
- use of vegetable oil in place of hydraulic fluids within the CRW;
- use of temporary mats to cross wetlands instead of permanent fill;
- use of special surveying techniques to minimize vegetation cutting;
- use of special clearing criteria to minimize clearing;
- use of helicopter within the CRW to remove cut trees to designated central areas, then removal by log trucks;
- restricting ground-disturbing activities to the dry season (May through September);
- use of erosion specialists and monitors for erosion control;
- purchasing land as replacement habitat for habitat affected by the proposed project;
- purchasing insurance for the unlikely event that drinking water quality is degraded;
- wetland mitigation including careful cutting and removal of only vegetation that are tall-growing species, reseeding where vegetation has been removed, and purchase of lands that contain wetlands and creeks and have other environmental/social benefits;
- special mitigation (best management practices) within the CRW concerning noxious weed removal/control and general vegetation management for wildlife habitat;
- special care along creeks important to fish habitat and water quality by removing only tall-growing vegetation within and immediately next to the ROW and replanting/seeding low growing vegetation;
- no vehicular crossing of the Cedar River within the CRW including no vehicular use of the current bridge within the CRW and no crossing of the Cedar River by a helicopter with a load of logs;

- use of two double-circuit towers to cross the Cedar River within the CRW and no clearing of vegetation near the Cedar River. Remove two existing towers and put the new line and the existing 500-kV line onto the new double-circuit towers.

The following equipment and activities would be part of the Proposed Action (most are shared in common with the other transmission alternatives):

S.2.1.1 Transmission Structures

About 47 lattice steel transmission towers would support the 500-kV transmission line. These structures average 135 feet high, with the average span between towers about 1,150 feet.

➞ For Your Information

Micropiles — A type of footing that involves augering holes about 6 inches in diameter to a depth of approximately 30 feet, inserting 1 steel bar into the holes, then grouting the bar in place using a cement grout. Using micropiles reduces the amount of ground disturbance required.

For the Proposed Action, BPA is proposing a new type of footing that requires less ground disturbance. The new footing design would use what are known as **micropiles** instead of the standard footing designs. Site grading would not be required. Brush clearing would only be necessary for the tracked equipment to operate. Most vegetation would not need to be uprooted. Tree stumps at footing sites may need to be ground down to ground level or removed, but could be crushed, bent over, broken or trimmed to the ground. The tower leg normally embedded in the ground would be above ground, so limited excavation would be required other than drilling. This method of securing the footing to the tower leg would typically disturb an area of about 10 square feet per tower leg for a total of 40 square feet at each tower site. BPA estimates that this new design would reduce the area of site disturbance within the CRW by about 16 acres, and about 16 acres on land outside the CRW.

Towers would be lifted into place in the CRW by sky-crane helicopters to reduce disturbance.

S.2.1.2 Conductors and Insulators

Conductors, wires that carry electrical current on a transmission line, are suspended from towers with insulators. Insulators are made of nonconductive materials (porcelain or fiberglass) that prevent electric current from passing through the towers to the ground. Conductors are installed on the insulators, often by helicopter, after the towers have been built. Then two overhead **ground wires** are attached to the top of the towers for lightning protection. There is also a series of wires (called counterpoise) buried in the ground and a grounding well at each structure to establish a low resistance path to earth, usually for lightning protection. Finally, one fiber optic cable needed for communications would be strung on the new line.

➞ For Your Information

Ground wire is wire that is strung from the top of one structure to the next; it shields the line against lightning strikes.

➞ For Your Information

Danger trees — Trees (or high growing brush) in or alongside the right-of-way, which are hazardous to the transmission line.

S.2.1.3 Right-of-Way Clearing

BPA would acquire easements to build, operate and maintain the new transmission line across public and private properties. The Proposed Action would require 150-feet of new right-of-way over nine miles.

If tall trees outside the 150-foot easement could fall and damage the line, BPA would acquire rights that allow BPA to remove these “***danger trees***.” BPA would also acquire rights to use private roads to access the transmission line ROW. When no existing roads are near the ROW, BPA would acquire an access road easement that allows BPA to construct a new road.

For safe and uninterrupted operation of the transmission line, vegetation within the ROW would then need to be cleared. BPA would develop a clearing plan to guide the construction contractor hired to clear off and on the ROW. The plan would specify the allowable vegetation heights along and at varying distances from the line. Generally, all tall-growing vegetation (trees and woody brush) would be removed from the 150-foot right-of-way, as well as identified danger trees outside the ROW.

Where the Proposed Action crosses the CRW, BPA would use different clearing criteria that would take fewer trees. This “stable tree” criteria would leave trees considered stable in place, even though they may be tall enough to fall into the transmission line.

S.2.1.4 Access Roads

Easements — BPA normally acquires access road easements and develops and maintains permanent road access to each of its transmission line structures. Surfaced with crushed gravel, access roads are designed for trucks and equipment used during construction and maintenance of the line and may include short spur roads (roads that go to a structure if the structure is not located on a trunk road).

Easements for new roads outside the proposed transmission line ROW would be 50 feet wide. Typically, new or existing access roads would be graded to provide a 16-foot travel surface, with an additional 4-6 feet to accommodate curves. However, due to the use of the new tower footing design (micropiles) and use of helicopter tower erection, there would be no need for heavy equipment (track hoe and crane) for all but one of the transmission towers. Ground crews would require only smaller vehicles, including track-mounted or multi-tire vehicles, such as log trucks, to complete clearing and installation. As a result, access road requirements can be reduced in the Cedar River Watershed, in particular the width of the roads (from 16 feet to 10-14 feet). This means most existing roads do not need to be widened and

BPA can reduce road requirements by 10-15 acres. (In those areas where access is or would be inadequate for a logging truck, trees would either be left on the ground or taken out by helicopter.) Precise access road locations would be coordinated with landowners to minimize impacts on property.

Stream Crossings — New and existing access roads may cross rivers and both perennial and intermittent streams. No new bridges or stream crossings would be constructed and no new culvert locations across streams are needed for this project.

Gates — Access roads that cross private timberlands and lands managed by the CRW would be gated and locked in accordance with the wishes of landowners and land managers. BPA would install nine gates.

S.2.1.5 Staging Areas

During transmission line construction, tower steel, electrical conductors, insulators and hardware are often stockpiled at sites called staging areas. The contractor(s) hired to construct the line could secure temporary rights to establish staging areas somewhere near the center and at both ends of the proposed line. To facilitate construction efficiency, staging areas tend to be located next to major highways and often are former industrial storage yards. When helicopters are used to build the transmission line structures, staging areas are typically used to pre-assemble the towers for helicopter delivery to tower sites and are used as fueling sites for those helicopters. Staging areas are only used during construction. Although the staging area locations have not yet been determined, none would be located within the CRW.

➞ For Your Information

A **bay** is an area set aside in a substation for special equipment.

S.2.1.6 Substation Facilities

Expansion of Echo Lake Substation would include construction of a new 500-kV **bay** (terminal) on BPA property immediately east of the substation. The size of the expansion would be 150 feet by 750 feet. The site would be cleared, fenced and graded. A short section of the existing road around the substation would be realigned to the east.

S.2.1.7 Maintenance

Once the new line is built, BPA would manage vegetation on the new rights-of-way as it does on existing ROWs and substation sites. This includes manual, mechanical, biological and chemical (herbicide) maintenance activities. BPA uses an integrated vegetation management (IVM) approach, which looks at existing environmental conditions and selects a vegetation management strategy best suited to these conditions. If threatened or endangered fish, animal, or plant species listed under the Endangered Species Act (**ESA**) are found along a

transmission line route, buffer zones are defined around these areas and no herbicides are used. This practice also applies to riparian areas. The IVM plan would insure that the mitigation measures identified in the EIS and implemented during construction would be carried forward and maintained throughout the life of the line.

At the landowner's request, no herbicides would be used in the Cedar River Watershed. BPA has not used herbicides in the Watershed for the past 16 years.

S.2.2 Alternative 2

Alternative 2 would originate from a tap point about 1.5 miles east of the tap point for the Proposed Action and traverse northwest about three miles before continuing north paralleling the existing Raver-Echo Lake Transmission Line into Echo Lake Substation. This alternative would be approximately nine miles long.

Alternative 2 has all the components of the Proposed Action, but would require 2.7 miles of new access roads. About 0.6 miles of existing access roads would be removed from service. It would require additional clearing because part of the route would be on new ROW, not next to the existing line. Alternative 2 was explored because it would avoid impacting two residences and a small subdivision affected by the Proposed Action.

The estimated cost for Alternative 2 is \$22.5 million, plus the estimated \$6.5 million for the substation expansion. The cost of mitigation measures would increase the overall cost for Alternative 2 by \$4 million, for a total project cost of \$34 million. Mitigation measures would largely be the same as those proposed for the Proposed Action.

S.2.3 Alternative 3

Alternative 3 would begin at the same tap point as Alternative 2. From this point, it would traverse northeasterly then turn north-northwesterly to Echo Lake Substation. This alternative would be about 10.2 miles long, or about 1 1/4 miles longer than the Proposed Action. It would also require additional clearing because none of the route is next to the existing line. Alternative 3 was considered to better meet Western Electricity Coordinating Council reliability criteria, which requires its members to study all outages of two parallel lines on the same ROW if the outage has a statistical frequency of more than one occurrence in 300 years. The benefit of this routing alternative is that it provides enough separation from the existing line to provide increased reliability. Alternative 3 has the same components as the Proposed Action, but requires about 6.4 miles of new access roads; no roads would be abandoned.

The estimated cost for the transmission line is \$25.5 million, plus the estimated \$6.5 million for the substation expansion. Mitigation measures similar to those proposed for the Proposed Action could increase costs by an additional \$5 million, for a total project cost of around \$37 million.

S.2.4 Alternative 4A

Alternative 4A would begin at the same tap point as Alternative 2 (see Map 2). About one-third of the way along Alternative 2, this alternative turns northwest to connect with the Proposed Action. Alternative 4A has the same components as the Proposed Action, with about the same transmission line length (9.5 miles), and similar new access road requirements (2.7 miles). About 0.6 miles of existing access roads would be removed from service. It would require additional clearing because part of the route would be on new ROW, not next to the existing line. It was considered to avoid the two residences and the small subdivision adjacent to the Proposed Action, while avoiding a second separate crossing of the Cedar River further upstream from the existing crossing.

The estimated cost for Alternative 4A is the same as the Proposed Action, \$23.5 million plus the estimated \$6.5 million for expanding the substation. Mitigation measures could add \$5 million more in costs to bring the overall project cost for Alternative 4A to \$35 million. Proposed mitigation measures for this alternative are largely the same as those for the Proposed Action.

S.2.5 Alternative 4B

Alternative 4B would begin at the same tap point as Alternative 2. About half way along Alternative 2, this alternative would traverse southwest to connect with the Proposed Action. Alternative 4B has the same components as the Proposed Action, with an equivalent transmission line length (9.2 miles). It would require about 2.2 miles of new access roads. About 0.6 miles of existing access roads would be removed from service. It would require additional clearing because part of the route would be on new ROW, not next to the existing line. Alternative 4B was considered for the same reasons identified in Alternative 4A, plus the added benefit of taking advantage of established clearing in the CRW for the existing 115-kV transmission line parallel to Pole Line Road, and using this county road for access to the proposed power line.

The estimated cost for Alternative 4B is the same as the Proposed Action, \$23.5 million plus the estimated \$6.5 million for expanding the substation. The cost of mitigation measures could increase Alternative 4B's costs by \$5 million, for a total project cost of \$35 million. The

mitigation measures proposed for Alternative 4B are largely the same as those for the Proposed Action.

S.2.6 Alternative A

Alternative A would require construction of about 20 miles of new 500-kV transmission line on mostly rural residential land, on mostly existing ROW. The alternative would use a vacant ROW between the tap point along the existing transmission line near Kangley, to a point near Covington Substation, immediately north of a portion of an existing 230-kV transmission line (see Map 1). Some new ROW would need to be acquired around the northeast side of Covington Substation to connect two transmission line ROWs, which is adjacent to Covington Substation. Connecting these two existing transmission line ROWs may require removing/relocating approximately 25 homes and displacing two undeveloped tax lots. In all, Alternative A impacts 401 tax lots along its route, 242 of which are developed.

BPA is considering an option for this alternative (Option A1) that would impact fewer homes. This option would run through Covington Substation (see Map 3) on mostly BPA-owned land.

The existing single-circuit 230-kV line from Covington Substation to the north to a tap point on an existing double-circuit 500-kV transmission line would need to be torn down and replaced with a new double-circuit transmission line. This new transmission line would have a 230-kV line on one side and a 500-kV line on the other. The 500-kV circuit would tap one of the vacant 500-kV circuits, on an existing double-circuit 500-kV line coming from the west to take the power into Echo Lake Substation (see Map 1).

The estimated construction cost for Alternative A is \$44.5 million, plus the estimated \$6.5 million to expand the substation. General mitigation measures (described below) could boost this cost by \$2.5 million, for a total project cost of \$53.5 million. In addition, the use of tubular poles to mitigate views from homes very near the new line would add \$3.5 million in costs, bringing the total to \$57 million for this alternative.

If Option A1 (crossing mainly BPA land near Covington Substation) were pursued, the estimated construction cost is \$37 million. This is less than the original Alternative A because of reduced property acquisition costs. The substation expansion and general mitigation measures would boost this total by about \$8.5 million and tubular poles would cost an additional \$3.5 million, for a potential total project cost of \$49 million.

The following mitigation measures are proposed for Alternative A:

- minimizing wetland impacts and mitigate for any fill and tree removal in wetlands;

- use of special clearing criteria;
- restricting the construction period to the dry season;
- use of erosion specialists and monitors for erosion control;
- use of special care and design for crossing fish-bearing streams;
- use of special care and mitigation for crossing the City of Kent's watershed;
- measures needed for the approximately 401 landowners potentially affected;
- special care for construction near residences, particularly when removing small existing buildings and disrupting areas currently used as extensions of residents' properties (such as extending backyards into the vacant ROW).

As previously noted, Alternative A uses a vacant circuit on the Maple Valley-Echo Lake line. As loads grow, BPA would normally use this circuit. If Alternative A were selected, a new 500-kV single-circuit line may need to be built in the future at an estimated cost of \$19 million. This cost also needs to be considered when evaluating this alternative.

S.2.6.1 Transmission Structures

The single-circuit 500-kV line between the tap point near Kangley would be supported by single-circuit towers approximately 135 feet high, and the double-circuit line between Covington and the vacant circuit of the Maple Valley-Echo Lake line would be supported by towers approximately 180 feet high. Tangent structures and several dead-end structures would be used. For most of this alternative, BPA would use plate, grillage, and rock anchor footings. BPA would use micropile footings in the city of Kent's watershed.

S.2.6.2 Conductors and Insulators

Conductors, insulators, ground wire and fiber optic cable used would be the same as that described under the Proposed Action.

S.2.6.3 Right-of-Way Clearing

Alternative A would require 150 feet of new ROW width over about one mile. For Option A1, about one-quarter mile of new ROW would be needed.

Clearing would be required within the existing ROW where trees have been allowed to grow. Some trees outside the ROW, if

determined to be unhealthy or danger trees, would need to be removed. A total of 397 acres of vegetation would be impacted by clearing (118 acres, or 30 percent of this total, would be forested stands permanently converted to non-forest use).

S.2.6.4 Access Roads

About 6.6 miles of new access road would need to be acquired to build and maintain the new transmission line.

S.2.6.5 Staging Areas

Staging areas for this alternative have not been determined.

S.2.6.6 Substation Facilities

Additions to Echo Lake Substation are required for the proposed 500-kV transmission line. Components would be the same as the Proposed Action.

S.2.6.7 Communication and Maintenance

See the Proposed Action.

S.2.7 Alternative B

For this alternative, 35.6 miles of the existing 345-kV single-circuit transmission line and towers between Stampede Pass and Echo Lake Substation would be torn down and new double-circuit towers erected to accommodate two new 500-kV lines. Alternative B would tap an existing 500-kV line just east of Stampede Pass and divert power to Echo Lake Substation (see Map 1). The new double-circuit line would operate on one side at 345-kV (like the existing line) and the other at 500-kV. The new double-circuit line would be built mostly on existing ROW, but would impact 110 tax lots, of which 20 are developed. No homes would be displaced. This alternative crosses the Mt. Baker-Snoqualmie and Okanogan-Wenatchee National Forests.

The estimated construction cost for Alternative B is \$77 million, plus the estimated \$6.5 million to expand the substation. Mitigation measures (described below) could boost this cost by \$4 million, for a total project cost of \$87.5 million. The following mitigation measures would likely be required for this alternative:

- compensatory mitigation for wetland impacts and timber removed in sensitive/critical areas;
- seasonal restrictions on construction operations for wildlife protection;

- special design elements;
- special construction techniques;
- improvement of existing BPA roads to meet standards of operation and maintenance on USFS-managed lands;
- special environmental considerations associated with the line's location near I-90;
- measures needed for the approximately 110 landowners potentially affected; and
- surveys required for Survey and Manage and Threatened and Endangered species.

S.2.7.1 Transmission Structures

Alternative B would replace the existing 150-foot double-circuit towers that are over 50 years old with 180-foot double-circuit towers. Tangent structures and several dead-end structures would be used. BPA would use plate, grillage, and rock anchor footings for this alternative.

S.2.7.2 Conductors and Insulators

Conductors, insulators, ground wire and fiber optic cable used would be the same as that described under the Proposed Action.

S.2.7.3 Right-of-Way Clearing

The new transmission line would be built mostly on existing ROW with the exception of a short segment within the Wenatchee National Forest, where the line would tap the Schultz-Raver No. 2 500-kV Transmission Line. BPA would acquire special use permits from the Forest Service and easements from other property owners where BPA does not already have a permit or easement.

About 250 acres of vegetation would need to be cleared within and adjacent to the existing Rocky Reach-Maple Valley line ROW to accommodate the double-circuit line. Of that total, 210 acres, or 84 percent, would be forested stands permanently converted to non-forest use.

S.2.7.4 Access Roads

Alternative B would follow an existing transmission line ROW; therefore, new access road construction would be limited to improving the existing trunk access and spur roads, reconstructing some spur roads to improve drainage, and constructing some new, short spur roads to any new tower locations. About two miles of new access road would need to be acquired to build and maintain the new transmission line. BPA would acquire access road easements on existing roads to access

the transmission line ROW or road use permits from the Forest Service. When no existing roads are near the ROW, BPA would acquire special use permits allowing construction of new roads.

Many of the existing roads would need upgrading. It is likely several culverts would need to be replaced.

S.2.7.5 Staging Areas

Staging areas for this alternative have not been determined.

S.2.7.6 Substation Facilities

Additions to Echo Lake Substation are required for the proposed 500-kV transmission line. Components would be the same as the Proposed Action.

S.2.7.7 Communication and Maintenance

See the Proposed Action.

S.2.8 Alternative C

Alternative C has two options, Option 1 and Option 2. Option C1 is approximately 10.1 miles long and Option C2 is approximately 10.6 miles long (see Map 1). Both would require new ROW away from existing transmission lines. Option C1 would begin at Raver Substation and proceed 2.5 miles west immediately north of and parallel to an existing double-circuit 500-kV transmission line on new 150-foot-wide ROW, before turning north and traveling about 7.6 miles on new 150-foot ROW through the rural residential areas of Ravensdale and Hobart. The proposed line would then tap the vacant circuit on an existing double-circuit 500-kV transmission line, west of Echo Lake Substation, just north of State Route 18 (**SR 18**). Power would be carried by this existing transmission line into Echo Lake Substation, following the completion of a short segment at Echo Lake Substation similar to that described at the north end of Alternative A.

Option C2 would begin at a tap point on an existing 500-kV double-circuit transmission line near Kangley, about 2.8 miles northeast of Raver Substation, and traverse about 4.5 miles west within a vacant transmission line ROW immediately north of a 230-kV transmission line, before turning north and continuing on the same alignment as Option C1 into Echo Lake Substation.

Both options would cross primarily private land. Option C1 would cross 128 tax lots, of which at least 54 are developed; 30-35 homes could be displaced. Option C2 would cross 134 tax lots, of which 56 are developed; 23-28 homes could be displaced.

The estimated construction cost for Option C1 is \$46.5 million, which includes the estimated \$6.5 million to add new equipment to Raver Substation. Adding the estimated \$6.5 million to expand Echo Lake Substation and \$5.5 million in estimated general mitigation costs would boost the total project cost to \$58.5 million. In addition, the use of tubular poles to mitigate views from homes near the new line would add \$1.2 million in costs, bringing the total to \$59.7 million for this alternative.

If Option C2 were pursued, the estimated construction cost is \$32.5 million, plus the estimated \$6.5 million cost of expanding Echo Lake Substation. General mitigation measures could boost this total by \$4 million and tubular poles would cost an additional \$1.2 million, for a potential total project cost of \$44.2 million.

The following mitigation measures are proposed for both Alternative C options:

- minimizing wetland impacts;
- use of special clearing criteria;
- restricting the construction period to the dry season;
- use of erosion specialists and monitors for erosion control;
- use of special care and design for crossing fish-bearing streams;
- use of special care and mitigation for crossing the city of Kent's watershed;
- measures needed for the landowners potentially affected (128 under Option C1; 134 under Option C2); and
- special care for construction near residences, particularly when removing trees adjacent to the ROW.

As previously noted, Alternative C uses a portion of the vacant circuit on the Maple Valley-Echo Lake line. As loads grow, BPA would normally use this circuit. If Alternative C were selected, a new 500-kV single-circuit line may need to be built in the future at an estimated cost of \$9 million. This cost also needs to be considered when evaluating this alternative.

S.2.8.1 Transmission Structures

Both options would use single-circuit 500-kV towers approximately 135 feet high. Tangent structures and several dead-end structures would be used. BPA would use plate, grillage, and rock anchor footings for both options.

S.2.8.2 Conductors and Insulators

Conductors, insulators, ground wire and fiber optic cable used would be the same as that described under the Proposed Action.

S.2.8.3 Right-of-Way Clearing

Option C1 would require 150 feet of new ROW width over about 10.1 miles. Option C2 would require 150 feet of new ROW over about 6.1 miles.

For Option C1, about 195 acres of vegetation would need to be cleared, of which about two-thirds (130 acres) would be forested stands permanently converted to non-forest use. For Option C2, about 206 acres of vegetation would need to be cleared, of which 56 percent would be permanently converted forested stands.

S.2.8.4 Access Roads

Option C1 would require approximately 8.7 miles of new access roads, while Option C2 would require about 8 miles of new access roads.

S.2.8.5 Staging Areas

Staging areas for this alternative have not been determined.

S.2.8.6 Substation Facilities

Additions to Echo Lake Substation are required for the proposed 500-kV transmission line. Components would be the same as the Proposed Action.

Option C1 would start at Raver Substation and similar equipment as is proposed at Echo Lake Substation would be installed at Raver Substation.

S.2.8.7 Communication and Maintenance

See the Proposed Action.

S.2.9 Alternative D

Alternative D would tap an existing 500-kV line just east of Stampede Pass and divert power to Echo Lake Substation over 35.6 miles of new single-circuit 500-kV transmission line.

Alternative D has two options, Option D1 and Option D2. Option D1 is located immediately adjacent to and south of the existing 345-kV line; Option D2 is located immediately adjacent to and north of this line. Either option would entail acquiring and clearing a new

150-foot wide ROW and building a new 500-kV single-circuit transmission line. Option D1 crosses 134 tax lots, of which 32 are developed; 11-14 homes would be displaced. Option D2 crosses 121 tax lots, of which 22 are developed; eight homes would be displaced. Both options cross the Mt. Baker-Snoqualmie and Okanogan-Wenatchee National Forests.

The estimated construction cost for Option D1 is \$55.5 million, plus the estimated \$6.5 million to expand Echo Lake Substation. Mitigation measures could increase costs by \$10.5 million, for a total project cost of \$72.5 million.

The estimated construction cost for Option D2 is \$53 million, plus the estimated \$6.5 million to expand Echo Lake Substation. Mitigation measures could increase costs by \$11 million, for a total project cost of \$70.5 million.

The following mitigation measures would likely be required for this alternative:

- compensatory mitigation for wetland impacts and timber removed in sensitive/critical areas;
- seasonal restrictions on construction operations for wildlife protection;
- special design elements;
- special construction techniques;
- improvement of existing BPA roads to meet standards of operation and maintenance on Forest Service managed lands;
- potential relocation of roads;
- special environmental considerations associated with the line's location near I-90;
- measures needed for the approximately 134 landowners potentially affected by Option D1 and 121 landowners potentially affected by Option D2.
- surveys required for survey and manage and threatened and endangered species; and
- requirements to mitigate for potential impacts to threatened and endangered species and survey and manage species that are discovered.

S.2.9.1 Transmission Structures

Alternative D (either option) would be supported by steel towers approximately 150 feet tall, about the same height as most of the

existing towers supporting the Rocky Reach–Maple Valley line that would be next to this new line. BPA would use tangent structures, several dead-end structures, and plate, grillage, and rock anchor footings for this alternative.

S.2.9.2 Conductors and Insulators

Conductors, insulators, ground wire and fiber optic cable used would be the same as that described under the Proposed Action.

S.2.9.3 Right-of-Way Clearing

The new transmission line would be built on new ROW. BPA would acquire a special use permit on National Forest land and easements on private land where BPA does not already own these rights. Options D1 and D2 would require 150 feet of new ROW width over about 35.6 miles.

In general, where new ROW is obtained, a strip of land about 150 feet wide would be cleared to allow for tower construction and conductor clearance. About 769 acres of vegetation would need to be cleared within the new ROW for Option D1. Of that amount, 82 percent (632 acres) would be forestland permanently converted to non-forest use. For Option D2, 776 acres of vegetation would be cleared, of which 89 percent (694 acres) would be permanently converted forestland.

S.2.9.4 Access Roads

About 13.6 miles of new access road would need to be acquired to build and maintain the new transmission line for Option D1 and 13.2 miles for Option D2. This would result in the clearing of 33 acres for Option D1 and 32 acres for Option D2. BPA would acquire access road easements on existing roads to access the transmission line ROW. When no existing roads are near the ROW, BPA would acquire easements that allow BPA to construct new roads.

Many of the existing roads would need upgrading. It is likely several culverts would need to be replaced.

S.2.9.5 Staging Areas

Staging areas for this alternative have not been determined.

S.2.9.6 Substation Facilities

Additions to Echo Lake Substation are required for the proposed 500-kV transmission line. Components would be the same as the Proposed Action.

S.2.9.7 Communication and Maintenance

See the Proposed Action.

S.2.10 Non-Transmission Alternative

Some commentors suggested that a variety of non-transmission alternatives such as Demand-Side Management (**DSM**), Distributed Generation (**DG**), large-scale generation (**G**) and Demand Response (**DR**), could defer or eliminate the need for a new transmission line. BPA examined the following:

Demand Response (DR) Programs — DR programs are a potential source of load reduction that could be exercised during a cold snap to prevent overloads on the Covington transformers. These options include Direct Load Control (**DLC**), interruptible/curtailable (non-firm) rates, and demand bidding (i.e., the Demand Exchange) to reduce loads when needed during system peaks. These types of solutions can be an effective approach to achieve load reductions because they directly address the capacity nature of the problem.

DR programs can be categorized into two major types: 1) price-based dispatch programs that offer customers incentives to voluntarily curtail load during the peak; and 2) pre-arranged contracts with customers (such as interruptible/curtailable rates or direct load control) that would require a customer to reduce loads during the system peak for a fixed price at BPA's request. These programs differ in their implementation and potential for providing load relief as discussed below. In this analysis we evaluate both price-based dispatch and interruptible/curtailable for their capability to provide the needed capacity to BPA.

Price-based dispatch programs are voluntary programs in which the price for curtailment or interruption is determined through a price convergence mechanism (i.e., auction, bidding system, etc.) between load serving entities and customers. Customers can choose the point at which the price available to them is high enough to offset their productivity losses from reducing or shutting-off their load. If the price offered by the load serving entity is high enough, then sufficient load reduction can, in all probability, be purchased at that price. While price-based dispatch programs result in a particularly efficient process of load reduction, they do not provide firm or guaranteed reductions in system load when needed.

Interruptible/curtailable contracts differ from the price-based dispatch programs because the terms (i.e., number of times/year the customer can be curtailed, maximum hours per interruption, and notification period for interruption) and the price (fixed component) are pre-determined and bound with an enforceable contract. By securing a contract for the load reduction, the available peak load relief is more

certain for planning purposes. This type of program is better suited for the type of system conditions driving the need for the transmission line, where extreme but infrequent weather conditions result in high levels of load relief required over relatively few hours of the year.

Demand-Side Management Measures — DSM measures are typically considered energy efficiency measures rather than peak shaving programs. However, certain measures such as heating efficiency and weatherization will reduce heating loads and have an impact on peak demand reduction so they were included in the economic screen.

Generation and Distributed Generation — There are a variety of generation options that could help to defer the transmission line, including both existing and new generation. In the course of this study we identified 277 MW of additional capacity that could potentially be available from existing generators in the Puget Sound area. An additional 270 MW of capacity is currently under construction. Together, these plants could provide up to 170 MW of relief at Covington Substation. Another 2,700 MW of capacity are either permitted or planned, although it is uncertain how much, if any, of this capacity will eventually be constructed.

BPA makes assumptions about the disposition of existing generators when it conducts its studies of the power flows across critical transmission system elements. BPA generally assumes that all generators in the Puget Sound area would be running to meet the extremely heavy loads during a cold snap. However, this analysis uncovered approximately 390 MW of capacity at several generating stations in the area that is not running for BPA's load flow studies. This capacity could potentially be called upon by BPA during the target hours.

In addition to the existing facilities, a number of new, large power plants have been proposed for the Puget Sound area since the late 1990s. Nearly all of these plants would be large natural gas-fired, combined-cycle combustion turbine plants. Together, these plants would add approximately 3,000 MW of generating capacity. Of course, many if not most of these projects will never be built. Still, even one of the larger projects could reduce the need for the transmission project.

Regional Availability of Natural Gas — One issue is the availability of natural gas, and the ability of the region's natural gas system to deliver the gas to all of the existing and new natural gas-fired generators in the Puget Sound area. As generating capacity would be needed by BPA during the highest loads of a cold snap, this time period would almost certainly experience extremely high coincident demand for natural gas. Like electricity transmission, the natural gas delivery system has a fixed peak delivery capacity; once the limits of the system are reached, there is very little that can be done on short notice to

increase deliveries. BPA relies on gas-fired generators to operate to avoid a Puget Sound-area blackout during a cold snap. Whether generators would be able to obtain firm gas supplies with the incentive level BPA can offer might not be known until the implementation phase.

Existing Distributed Generation — In addition to the existing large generation discussed above, there are also small-scale distributed generators in the Puget Sound region. According to estimates, existing idle DG at local industrial sites, banks, hospitals etc., amounts to approximately 60 MW in the region. This translates to less than 20 MW available at Covington Substation after applying the appropriate load flow factors. This idle capacity could potentially be called upon by BPA during the target hours.

New Distributed Generation — Small-scale, distributed generation can often serve as a substitute for investment in transmission or distribution circuits. However, in this case, the potential overload is sufficiently large and the load area sufficiently diverse such that distributed generation does not appear to be an economically viable alternative.

Renewable Generation and Emerging Technologies — Renewable generation such as wind and solar were not considered for this study, because their resource characteristics are a poor match for BPA's needs to defer the project. Wind energy was excluded because the Puget Sound Area is not home to a commercial-grade wind resource. Solar was excluded because the critical hours occur during the winter months when solar radiation is scarce, and many of the target hours occur during the evening. Fuel cells do not suffer from these disadvantages, and were considered for the high-level screen. However, their extremely high cost makes them unattractive as a substitute for the project.

S.2.11 No Action Alternative

The No Action Alternative is often called the no-build alternative. The environmental impacts described for each of the alternatives described above would not occur. The No Action Alternative does not mean there would never be a need for future transmission projects, only that no line would be considered for construction in this general area in the near future.

S.2.12 Alternatives Considered but Eliminated from Detailed Study

A wide variety of alternatives was considered. The following were eliminated when they were judged to not meet the purpose and need:

- **Building an underground transmission line** — Excessively high costs (as much as 10 times more) of this option prevented its further consideration. BPA considers undergrounding a tool for limited, special situations.
- **Energy conservation** — While BPA- and utility-sponsored conservation programs in the region have helped to reduce power demand, the magnitude of savings that can be accomplished is too small to defer the need for the new transmission line.
- **Load curtailment plan** — BPA has a curtailment plan in place that calls for cuts to firm transmission customers in the Puget Sound area when system conditions (such as a potential overload) require. While this plan can reduce load temporarily to protect the system, it is not a reasonable long-term solution to the region's additional transmission needs.
- **Transmission line route variations** — Other transmission line routes, some proposed by the public during the environmental scoping process, were considered.
- **Flexible AC Transmission Systems (FACTS)** — BPA invests in technological improvements that boost transmission capacity whenever it is cost efficient. Known as Flexible AC Transmission Systems, these advances in power electronics enhance the controllability and usable capacity of alternating current (AC) transmission systems. The current problem in the Puget Sound area, however, is lack of surplus transmission capacity. If the existing line goes out of service during a cold weather event, existing transformers and the underlying low voltage (230-kV) system will be overloaded. While it is theoretically possible to reroute power flow through other transformers and lines in the area with one or more FACTS devices, this would be a temporary solution at best. There is little margin left in the system. Remaining capacity, if any, will run out shortly. At that point a new line would be needed.
- **Revise the Columbia River Treaty** — BPA does not have authority to unilaterally change the terms of the treaty.